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Initial Print Date: 023/2000 Revision Date: 3/17/00

IHKA SYSTEMS - SOLAR SENSOR

E38 IHKA - March 1999 (2000 M/Y)
E46 IHKA - 2000 Model Year
E39 IHKA - 2001 Model Year

OBJECTIVES

After studying this handout, you will be able to:

- Describe the operation of the solar sensor as it applies to the IHKA systems.
- List the output functions effected by the solar sensor input.
- Describe how the solar sensor affects the various output functions.

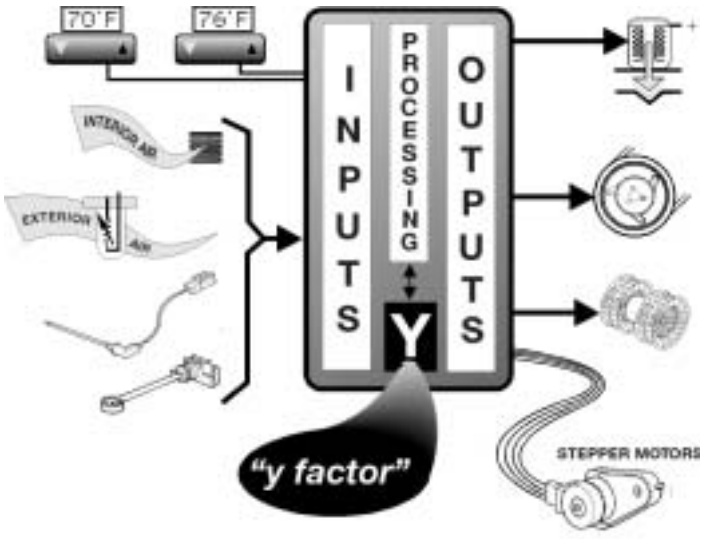
Purpose of the System:

The purpose of the solar sensor is to compensate the climate control system's output for the radiant heating effect of the sun. This will aid the IHKA in maintaining a constant comfort level, in the vehicle's interior, during all driving conditions.

The function of heating and air conditioning systems in BMW vehicles is to provide the driver and passengers a comfortable atmosphere regardless of conditions outside of the vehicle. Based on the temperature signal inputs, blower setting, flaps portioning, program settings in the control module and influencing variables, the IHKA control module is able to process these inputs to achieve the desired comfort level.

The following input variables are processed by the IHKA module:

- Interior temperature
- Heat exchanger temperature
- Ventilation temperature (E38)
- Evaporator temperature
- Air volume setting
- Engine temperature and RPM
- Exterior temperature



The processed variable "Y - factor" is determined by using the above inputs. The Y - factor then represents how much adjustment is necessary by the IHKA module to achieve the set temperature.

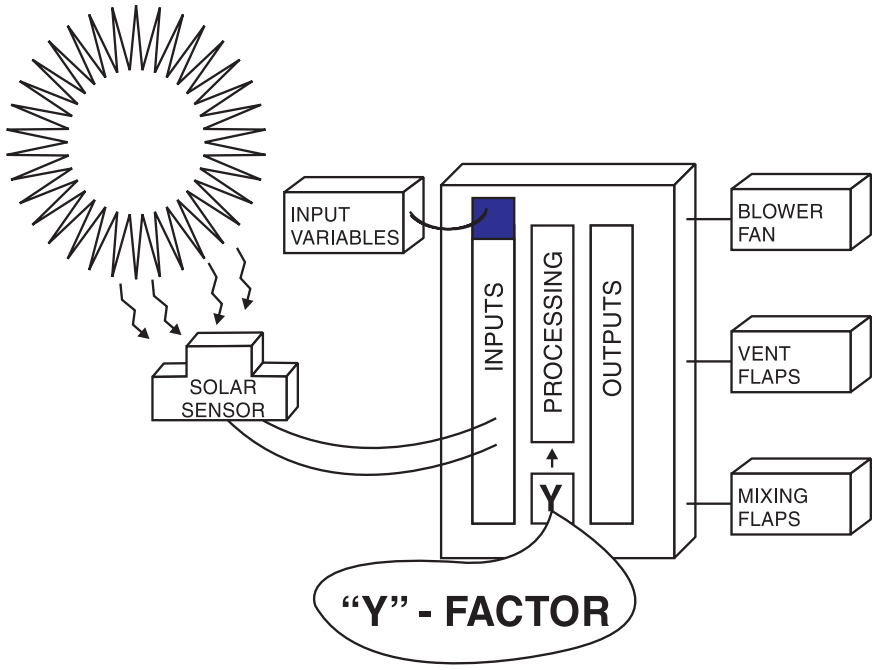
INTRODUCTION

Solar Radiation

Solar radiation, from the sun, passes through the earths atmosphere in the form of light (both visible and non-visible) and heat (sunshine). To date, the influence of solar radiation on the climate control system in the vehicle has only been compensated for by an average value stored in the control module and based on control settings and outside temperature values.

Solar Sensor

The solar sensor can detect the amount of solar radiation that is influencing the temperature and climate in the vehicles interior. The IHKA control module monitors the input from the solar sensor and adds the value to its processing factors. The settings of the climate control system are changed to compensate for this additional influence.



The settings of the following IHKA components are adjusted to compensate for changes in solar radiation:

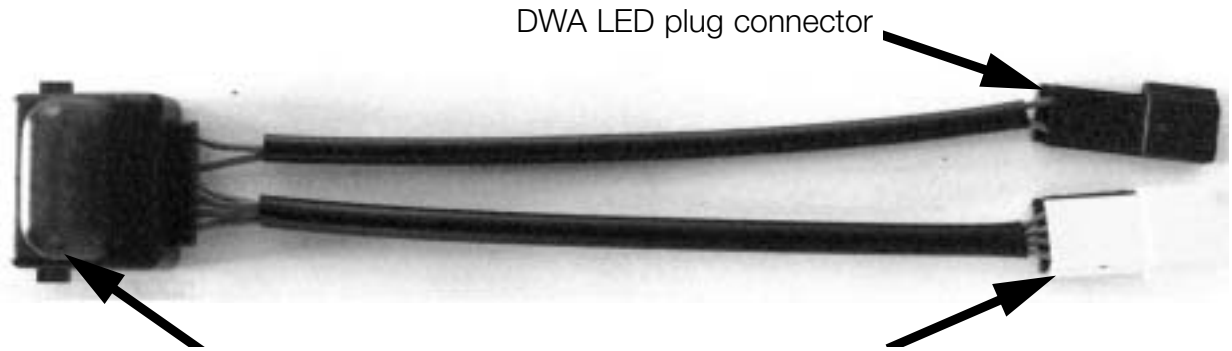
- Blower - The blower curve is changed
- Stratification (mixing flaps) - The stratification outlet air temperature is changed (not E46)
- Ventilation - The opening angles of the ventilation flaps are changed.

Components of the System:

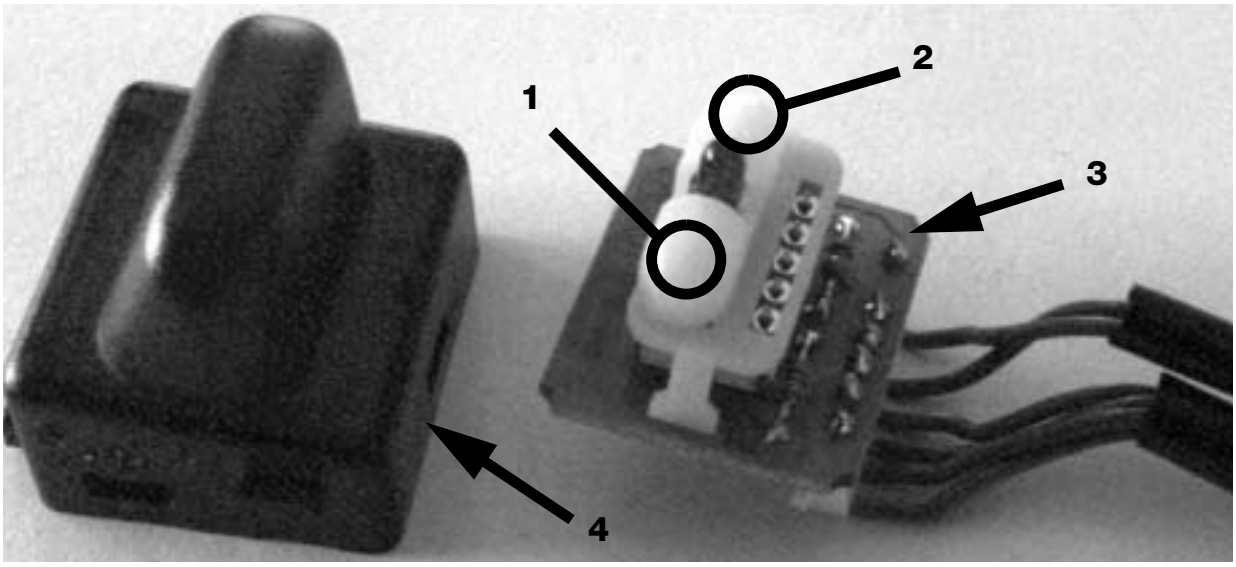
In the E38, The solar sensor is integrated in the housing of the anti-theft warning system LED. The warning indicator LED is installed on the outlet grille in the top center of the instrument panel where solar radiation can directly reach the solar sensor.

The DWA LED with solar sensor is an additional wiring harness with a 4-pin plug connector.

DWA LED with integrated solar sensor

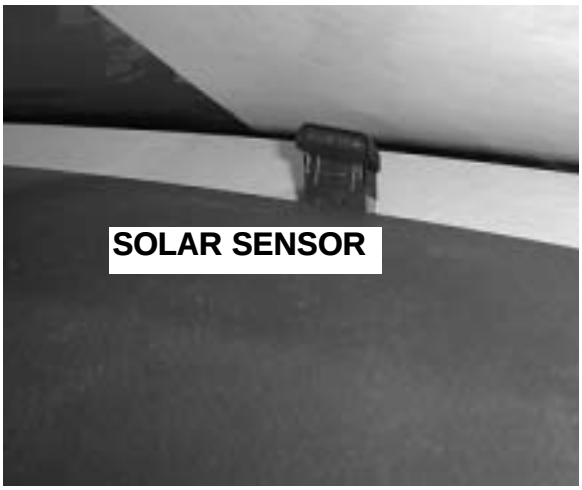


The solar sensor consists of two photoresistors, which are integrated on the left and right sides of the DWA housing next to the DWA LED. The photoresistors sense the different intensity levels of the solar radiation.



DWA LED dismantled; housing and pc-board with LED and solar sensor housing

1 The photoresistor on the right is fitted under the plastic cover
2 The photoresistor on the left is fitted under the plastic cover
3 PC-board, DWA LED and solar sensor
4 DWA LED housing



The E46 solar sensor is located in the right defroster outlet at the base of the windshield. The E46 sensor contains one photoresistor for sensing solar radiation.

System Operation

The solar sensor receives power (5 volts) and ground from the IHKA control module. The module then reads the voltage drop across the photoresistor and determines the degree of solar heating based on the change in voltage. The voltage drop across the photoresistor increases as solar radiation increases. The IHKA control module monitoring voltage will decrease indicating an increase in solar heating. The module processes the input every 10 seconds and checks it for plausibility based on a limit value monitoring function.

Values outside the limit indicate a malfunction and the signal from the sensor is ignored by the module.

As solar radiation levels increase, the control curves, stored in the IHKA module, for the blower fan, mixing flaps and ventilation (face vent) flaps are shifted to compensate for the additional heat.

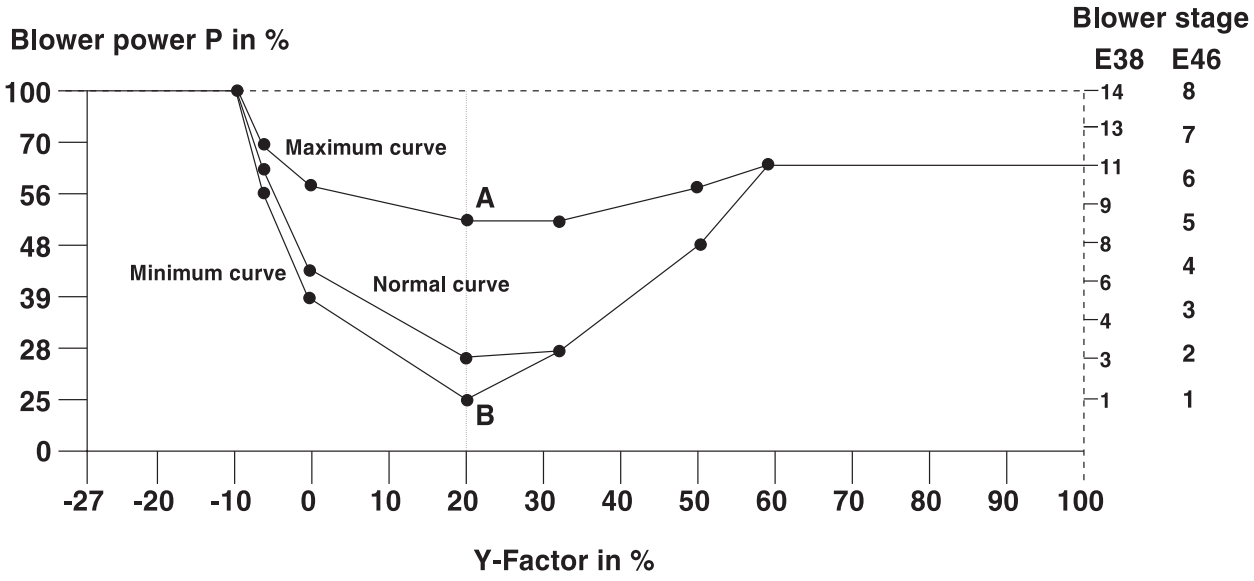
The solar sensor inputs to the IHKA control module can influence the settings on the relevant side (driver/front passenger) on the E38 and E39. No separate regulation is possible on the E46.

When driving at night, during cloudy periods or through tunnels, the control maps are shifted back to their base settings.

CONTROL CURVES OPERATION

Blower Intervention

The graph below illustrates the solar influence on the blower fan with a constant Y factor and the solar influence changing from 0 th 100%.



Blower power curves

The middle curve illustrates a blower curve without any solar influence. At a constant Y factor of 20%, the solar influence on the IHKA control module will cause the blower curve to shift as the radiation increases from 0 to 100%.

With a solar influence of 0%, curve “B” is used, providing 25% power to the blower.

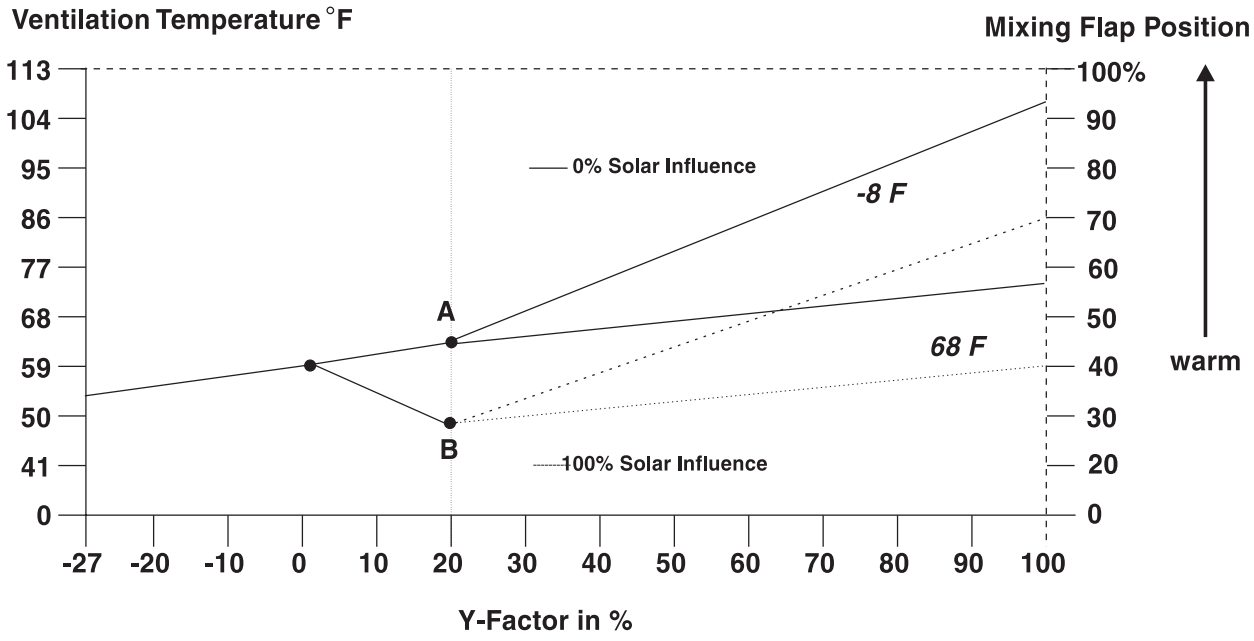
As the solar influence increases, the curve shifts upward until the solar influence reaches 100%. At this point, curve “A” is used providing 36% power to the blower.

During heating, the blower power decreases as solar influence increases.

While cooling, the blower power will increase as solar influence increases.

Stratification (Temperature Intervention) E38 only

The mixing flaps will open less in the direction of heat for blending air as the solar influence increases. The graph below represents the influence of the solar sensor on the stratification flap settings



To illustrate the influence of the solar sensor on the mixing flap position, the Y factor remains constant at 20%.

With a solar influence of 0% curve “A” is adopted for the various outside temperatures. As the outside temperature decreases, the mixing flap is moved toward the warmer setting blending more heat.

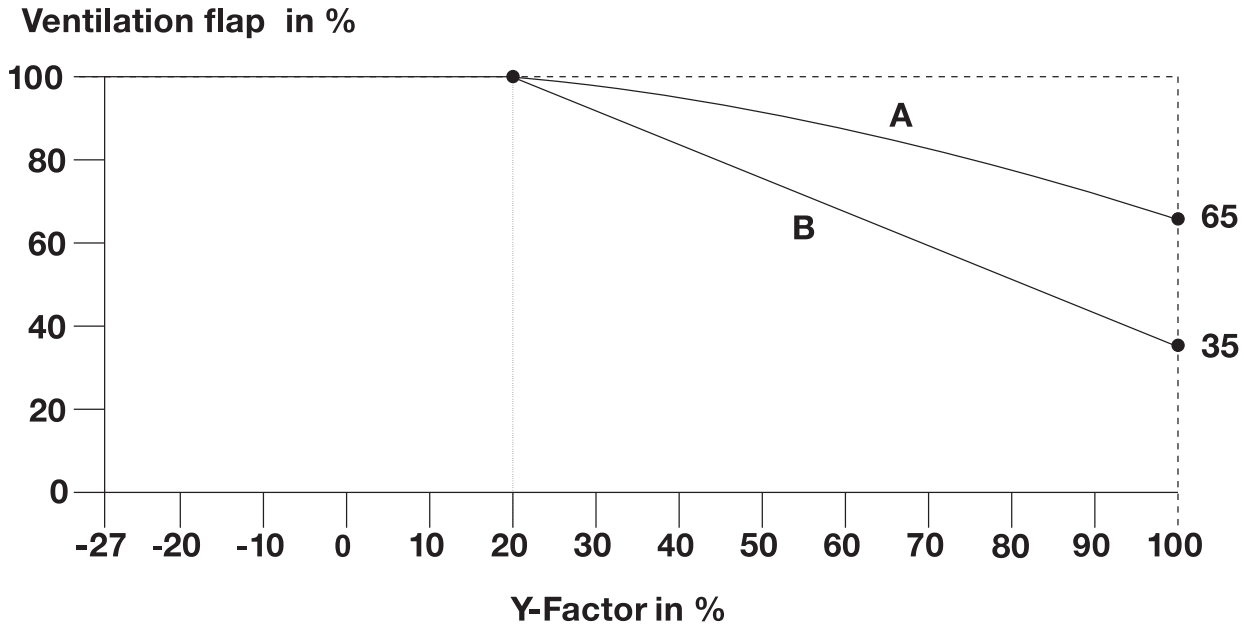
With a solar influence of 100% curve “B” is adopted for the various outside temperatures. As the outside temperature decreases, the mixing flap is still moved toward the warmer setting but it does not move as far. The solar influence is compensating to provide the same comfort level.

With the mixing flap thumbwheel at 100 or 0% (full hot or cold), the flaps are in the default position and there will be no solar influence.

The left and right mixing flaps are controlled independently based on the individual settings and left and right solar sensor inputs.

Ventilation Intervention (Center Vent Air Distribution)

The influence of the solar sensor on the ventilation flaps is shown in the graph below.



The normal curve “B” applies when there is no solar sensor influence 0%, or if the sensor is defective.

The maximum curve “A” applies when the solar influence is 100%.

The ventilation flaps will close less as the solar influence increases. This allows more cool air from the center vents as the solar radiation increases.

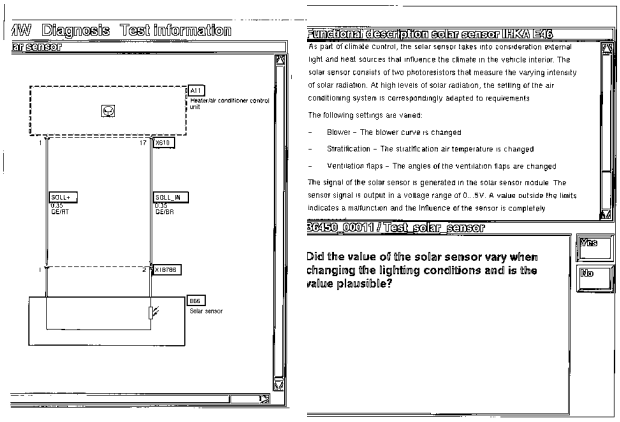
This adjustment is also independently adjustable on the E38 based on the left/right solar sensor inputs.

DIAGNOSIS

Troubleshooting of the solar sensor (left/right) is carried out through the IHKA diagnostic program using the DIS or MoDiC.

Status displays for the solar sensor input are available in percentages. The status displays can be checked while applying a light or heat source to the solar sensor to view the change in value.

The E436 diagnostic program for the IHKA system contains a test module B6450-00011 for testing the operation of the solar sensor.



The IHKA control module monitors the solar sensor and will set a fault code for:

- Shorts to B+ or ground
- Open circuits

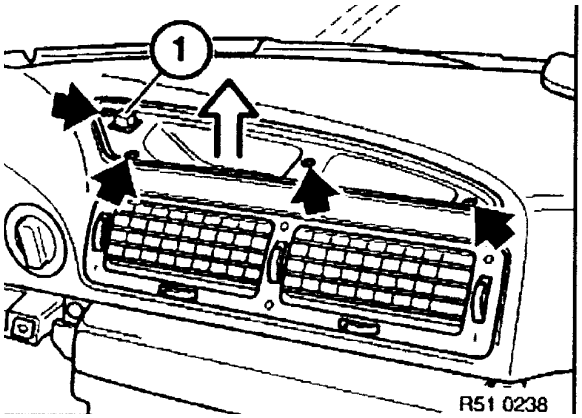
The IHKA control module will function as a system without solar influence correction if the sensor is defective.

Recognition of the solar sensor and its influencing capabilities is enabled via ZCS coding. Remember to adopt the code whenever possible to avoid loosing car/key memory function changes. Also the IHKA control module must be disconnected from B+ before coding can become permanent.

REMOVAL HINTS

E38 vehicles

To remove the solar sensor from an E38, refer to TIS - RM 6422161, removal of the center outlet grille at the top of the dash. After removal of the grille, disconnect the plug connector of the DWA indicator and solar sensor and pull the sensor from the grille.



E46 vehicles

Removal of the E46 solar sensor requires removal of the instrument panel. However, for testing purposes the connector is locates inline attached to the harness connector X610.

REVIEW QUESTIONS

1. What is the advantage of using the solar influence in the operation of the IHKA control system?

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_____

2. What are the three functions of IHKA operation influenced by the solar sensor input correction factor?

_____

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_____

3. What function is not corrected for with the E46 IHKA system?

_____

4. How can you test the operation of the solar sensor?

_____

_____